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Paper No. 19

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte JIGISH D. TRIVEDI

Appeal No. 2002-0043
Application No. 08/915,658

ON BRIEF

MAILED

OCT 04 2002

**PAT. & T.M. OFFICE
BOARD OF PATENT APPEALS
AND INTERFERENCES**

Before JERRY SMITH, GROSS, and BARRY, *Administrative Patent Judges*.
BARRY, *Administrative Patent Judge*.

DECISION ON APPEAL

A patent examiner rejected claims 31-40. The appellant appeals therefrom
under 35 U.S.C. § 134(a). We affirm.

BACKGROUND

The appellant's invention is a local interconnect for an integrated circuit ("IC"). In
the manufacture of ICs, interconnects provide electrical paths between field effect
transistors and other devices fabricated on a semiconductor substrate and the external
circuitry used to pass data to and from these devices. In particular, polycide structures
are commonly used to form the gate of a metal oxide semiconductor field effect

transistor ("MOSFET"). A local interconnect is typically used to connect the polycide gate to active semiconductor areas, such as the source or drain of another MOSFET. A local interconnect may also be used to connect active semiconductor areas to other active semiconductor areas separated by an insulating region, such as a field oxide region.

Titanium silicide (TiSi_2) is commonly used as a local interconnect for connecting desired polycide gates and active semiconductor areas. (Spec. at 1.) While TiSi_2 is a low resistive conductor, the appellant asserts that the titanium therein is susceptible to oxidation during and after its formation. (*Id.* at 2.) The resultant titanium dioxide (TiO_2) increases the sheet resistance of the interconnect,¹ he adds, thereby increasing power dissipation and reducing the speed of the device. (*Id.*) Further, the TiO_2 impedes the formation of good electrical contacts on the TiSi_2 interconnect and poses adhesion problems when subsequent layers are deposited on top of the interconnect. (*Id.*)

The appellant's local interconnect is formed from a refractory metal silicide. (*Id.* at 1.) The metal silicide is patterned to form the boundaries of the local interconnect and then reacted with an underlying layer of metal. Silicon from the metal silicide

¹Sheet resistance is an electrical quantity measured on a thin layer and has the units of ohms/square. (Spec. at 2.)

combines with the underlying metal to form another metal silicide. An intermetallic compound of titanium-tungsten (TiW), comprised of metal from the underlying metal layer and metal from the metal silicide, is also formed. The appellant asserts that the intermetallic TiW reduces the resistance of the local interconnect while also increasing its adhesion characteristics. (*Id.* at 13.)

A further understanding of the invention can be achieved by reading the following claim:

31. A local interconnect comprising:

a composite structure comprising a first metal silicide, a second metal silicide and an intermetallic compound comprising metal from said first metal silicide and metal from said second metal silicide.

Claims 31-34 stand rejected under 35 U.S.C. § 102(b) as anticipated by U.S. Patent No. 4,910,578 ("Okamoto"). Claims 35-40 stand rejected under 35 U.S.C. § 103(a) as obvious over Okamoto in view of U.S. Patent No. 5,227,333 ("Shepard").

OPINION

At the outset, we recall that claims that are not argued separately stand or fall together. *In re Kaslow*, 707 F.2d 1366, 1376, 217 USPQ 1089, 1096 (Fed. Cir. 1983) (citing *In re Burckel*, 592 F.2d 1175, 201 USPQ 67 (CCPA 1979)). Here, the appellant

argues claims 31-34 as a group, (Appeal Br. at 3), and claims 35-40 as another group. (*Id.*) Therefore, claims 32-34 stand or fall with representative claim 31, and claims 36-40 stand or fall with representative claim 35.

With this representation in mind, rather than reiterate the positions of the examiner or appellant *in toto*, we address the three points of contention therebetween. First, the examiner asserts, "Okamoto teaches the conditions under which the composite film may be formed in Col. 5, lines 35-61, and that a ternary silicide film is indeed an intermetallic compound." (Examiner's Answer at 7.) The appellant argues, "[s]ummarizing, Okamoto explicitly teaches the formation of a ternary silicide, not an intermetallic compound." (Appeal Br. at 7.)

"Analysis begins with a key legal question -- *what is the invention claimed?*" *Panduit Corp. v. Dennison Mfg. Co.*, 810 F.2d 1561, 1567, 1 USPQ2d 1593, 1597 (Fed. Cir. 1987). In answering the question, "the Board must give claims their broadest reasonable construction. . . ." *In re Hyatt*, 211 F.3d 1367, 1372, 54 USPQ2d 1664, 1668 (Fed. Cir. 2000). "Moreover, limitations are not to be read into the claims from the specification." *In re Van Geuns*, 988 F.2d 1181, 1184, 26 USPQ2d 1057, 1059 (Fed. Cir. 1993) (citing *In re Zletz*, 893 F.2d 319, 321, 13 USPQ2d 1320, 1322 (Fed. Cir. 1989)).

Here, representative claims 31 and 35 specify in pertinent part the following limitations: "an intermetallic compound. . . ." The adjective "intermetallic" means "composed of two or more metals or of a metal and a nonmetal. . . ." *Webster's Ninth New Collegiate Dictionary* 632 (1990)(copy attached). As noted by the appellant, "[a]ccording to Webster's, a compound of a metal and a non-metal is considered to be 'intermetallic.'" (Appeal Br. at 7.) Kirk-Othmer's Encyclopedia of Chemical Technology's reference to molybdenum silicide (MoSi_2) as an "intermetallic compound[]," vol. 20, p. 826 (1978)(copy attached), moreover, evidences that an intermetallic compound may include a nonmetal.

Giving the representative claims their broadest, reasonable construction, the limitations do not limit the components of "an intermetallic compound" to only metals as argued by the appellant. (Appeal Br. at 7; Reply Br. at 3.) Instead, claims 31 and 35 merely require a compound that includes a metal.

"[H]aving ascertained exactly what subject matter is being claimed, the next inquiry must be into whether such subject matter is novel." *In re Wilder*, 429 F.2d 447, 450, 166 USPQ 545, 548 (CCPA 1970). "[A]nticipation is a question of fact." *Hyatt*, 211 F.3d at 1371, 54 USPQ2d at 1667 (citing *Bischoff v. Wethered*, 76 U.S. (9 Wall.) 812, 814-15 (1869); *In re Schreiber*, 128 F.3d 1473, 1477, 44 USPQ2d 1429, 1431

(Fed. Cir. 1997)). "A claim is anticipated . . . if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros., Inc. v. Union Oil Co.*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987) (citing *Structural Rubber Prods. Co. v. Park Rubber Co.*, 749 F.2d 707, 715, 223 USPQ 1264, 1270 (Fed. Cir. 1984); *Connell v. Sears, Roebuck & Co.*, 722 F.2d 1542, 1548, 220 USPQ 193, 198 (Fed. Cir. 1983); *Kalman v. Kimberly-Clark Corp.*, 713 F.2d 760, 771, 218 USPQ 781, 789 (Fed. Cir. 1983)).

Here, we find that Okamoto teaches an intermetallic compound, viz., "a $Ti_xMo_ySi_z$ film 30," col. 5, l. 60, which is shown in Figure 4D of the reference. Because the $Ti_xMo_ySi_z$ film includes the metals titanium (Ti) and molybdenum (Mo), it is an "intermetallic compound."

Second, the examiner asserts, "Okamoto . . . shows in Fig. 4D an interconnect comprising a composite structure comprising a first metal silicide 4, a second metal silicide 8, and an intermetallic compound 30 comprising metal from the first metal silicide and metal from the second metal silicide." (Examiner's Answer at 3.) The appellant argues, "Okamoto does not mention expressly or inherently the formation of an intermetallic compound from two different metals in different metal silicide layers."

Claim 31 further specifies in pertinent part that its intermetallic compound "compris[es] metal from said first metal silicide and metal from said second metal silicide." Similarly, claim 35 further specifies in pertinent part its intermetallic compound "compris[es] refractory metal from said first refractory metal silicide and refractory metal from said second refractory metal silicide. . . ." Giving the representative claims their broadest, reasonable construction, the limitations merely require that the intermetallic compound comprise metal from two metal silicide layers.

We find that Okamoto's intermetallic compound comprises metal from two metal silicide layers. Specifically, the reference's $Ti_xMo_ySi_z$ film 30 comprises the metal Ti from the reference's "TiSi₂ film 4," col. 5, l. 37, and the metal Mo from its "MoSi₂ film 8. . . ." *Id.* Therefore, we affirm the rejection of claim 31 and of claims 32-34, which fall therewith.

Third, the examiner asserts, "it would have been obvious to one of ordinary skill in the art to use the interconnect of Okamoto to connect a source, drain or gate to another area within a substrate assembly as taught by Shepard." (Examiner's Answer at 5.) The appellant argues, "the teachings of Okamoto would not be properly combinable because a completely different semiconductor device is taught using different materials." (Appeal Br. at 9.)

Claim 35 further specifies in pertinent part the following limitations: "[a] local interconnect for connecting a first active semiconductor region to a second active semiconductor region on a substrate assembly. . . ." Giving the claim its broadest, reasonable construction, the limitations merely require connecting active semiconductor regions on a substrate.

Obviousness follows *ipso facto* from an anticipatory reference. *RCA Corp. v. Applied Digital Data Sys., Inc.*, 730 F.2d 1440, 1446, 221 USPQ 385, 390 (Fed. Cir. 1984). "[A] disclosure that anticipates under Section 102 also renders the claim invalid under Section 103, for 'anticipation is the epitome of obviousness.'" *Connell v. Sears, Roebuck & Co.*, 722 F.2d 1542, 1548, 220 USPQ 193, 198 (Fed. Cir. 1983) (quoting *In re Fracalossi*, 681 F.2d 792, 794, 215 USPQ 569, 571 (CCPA 1982)).

Here, we find that Okamoto's "unreactive TiSi_2 film 4, . . . $\text{Ti}_x\text{Mo}_y\text{Si}_z$ film 30 and an unreactive MoSi_2 film 8 as shown in FIG. 4D," col. 5, ll. 59-61, collectively connect two active semiconductor regions on a substrate. While Figure 4D specifically shows a "formation of ternary silicide films in the semiconductor device according to the embodiment of the present invention," col. 3, ll. 41-44, Figures 3A-3I more generally depict formation of the invention. "Referring to FIG. 3D, a impurity diffusion layer 5 is formed in a region of the silicon substrate 1 covered by the TiSi_2 film 4 through ion

implantation and heat treatment, so that the impurity diffusion layer 5 and the silicon substrate 1 form a P-N junction." Col. 4, ll. 4-8. "The silicon substrate 1 and the impurity diffusion layer are in P-N junction with each other to form a path for electric signals, which path corresponds to source/drain layers of a MOS element." Col. 1, ll. 36-39. This source layer and drain layer are the active semiconductor regions that the combination of Okamoto's TiSi_2 film 4, $\text{Ti}_x\text{Mo}_y\text{Si}_z$ film 30, and MoSi_2 film 8 connects.

"[S]ince anticipation is the ultimate of obviousness, . . . the subject matter of these claims is necessarily obvious and we need not consider them further." *In re Baxter Travenol Lab.*, 952 F.2d 388, 392, 21 USPQ2d 1281, 1285 (Fed. Cir. 1991) (citing *Fracalossi*, 681 F.2d at 794, 215 USPQ at 571. Nonetheless, regarding the combination of Okamoto and Shepard, "[w]hat appellant[] overlook[s] is that it is not necessary that the inventions of the references be physically combinable to render obvious the invention under review." *In re Sneed*, 710 F.2d 1544, 1550, 218 USPQ 385, 389 (Fed. Cir. 1983) (citing *Orthopedic Equip. Co. v. United States*, 702 F.2d 1005, 1013, 217 USPQ 193, 200 (Fed. Cir. 1983); *In re Andersen*, 391 F.2d 953, 958, 157 USPQ 277, 281 (CCPA 1968)). See also *In re Nievelt*, 482 F.2d 965, 968, 179 USPQ 224, 226 (CCPA 1972) ("Combining the teachings of references does not involve an ability to combine their specific structures."). The test for obviousness is not whether the features of a reference may be bodily incorporated into the structure of another

reference but what the combined teachings of those references would have suggested to one of ordinary skill in the art. *In re Keller*, 642 F.2d 413, 425, 208 USPQ 871, 881 (CCPA 1981).

Here, combining the teachings of Okamoto and Shepard does not involve an ability to combine their specific structures. "A process for making a local interconnection of devices on a semiconductor substrate is disclosed [by Shepard]." Abs. II. 1-2. It is for this general teaching of interconnecting devices on a substrate, rather than the specific structure of the interconnection, that the examiner relies on Shepard. The appellant's argument overlooks "the relevant combined teachings of the references." *Andersen*, 391 F.2d at 958, 157 USPQ at 281 (dismissing the argument that a combination would result in an inoperative structure). Therefore, we affirm the rejection of claim 35 and of claims 36-40, which fall therewith.

CONCLUSION

In summary, the rejection of claims 31-34 under § 102(b) and the rejection of claims 35-40 under § 103(a) are affirmed. Our affirmance is based only on the arguments made in the briefs. Arguments not made therein are neither before us nor at issue but are considered waived. No time for taking any action connected with this appeal may be extended under 37 C.F.R. § 1.136(a).

AFFIRMED

JERRY SMITH
Administrative Patent Judge

ANITA PELLMAN GROSS
Administrative Patent Judge

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inter-mediate \intin-ər-'med-ē-ət\ *adj* [ML. *intermediatus*, fr. L. *inter-* 'between' + *medius* 'middle, middle' — more at MID] (15c) 1: being or occurring at the middle place, stage, or degree or between extremes 2: of or relating to an intermediate school (an ~ curriculum) — **inter-mediate-ly** *adv* 1: one that is intermediate 2: **MEDIATOR** — **intermediate** *n* (1650) 1: an intermediate formed as an intermediate step GO-BETWEEN 3: a chemical compound formed as an intermediate step between the starting material and the final product 4: an automobile larger than a compact but smaller than a full-sized automobile — **inter-mediate** \-ē-āt\ *v* [ML. *intermediatus*, pp. of *intermediare*, fr. L. *inter-* + LL. *mediare* to mediate] (1610) 1: **INTERVENE**, **INTERPOSE** 2: to act as an intermediate — **intermediate host** *n* (1878) 1: a host which is normally used by a parasite in the course of its life cycle and in which it may multiply asexually but not sexually 2: a: **RESERVOIR** 3: **VECTOR** — **intermediate school** *n* (1842) 1: **JUNIOR HIGH SCHOOL** 2: a school usually comprising grades 4 to 6 — **inter-mediation** \intin-ər-'med-ē-'ā-shən\ *n* (1602): the act of coming between: **INTERVENTION**, **MEDIATION** — **inter-med-in** \intin-ər-'med-ē-n\ *n* (1932): **MELANOCYTE-STIMULATING HORMONE** — **inter-ment** \in-'tar-mənt\ *n* (14c): the act or ceremony of interring — **inter-metallic** \intin-ər-'mə-tal-ik\ *adj* (1900): composed of two or more metals or of a metal and a nonmetal: esp: being an alloy having a characteristic crystal structure and usu. a definite composition — **inter-metallic** *n* — **inter-mez-zo** \intin-ər-'mets-ō\ *n* pl. -zi \-ē\ or -zos [It. deriv. of L. *intermedius* intermediate] (1771) 1: a short light entr'acte 2: a movement coming between the major sections of an extended musical work (as an opera) b: a short independent instrumental composition — **inter-mi-na-ble** \(hīn-'tɔrm-ə-'hə-bə-l\ *adj* [ME. fr. LL. *interminabilis*, fr. L. *in-* + *terminare* to terminate] (15c): having or seeming to have no end: esp: wearisomely protracted (an ~ sermon) — **inter-mi-na-ble-ness** *n* — **inter-mi-na-ble-ly** \-bəl\ *adv* — **INTERMIX** — **inter-ming-le** \intin-ər-'mɪŋ-gəl\ *vb* (15c): **INTERMIX**, **intermissio, fr. *inter-* + *missio*, pp. of *intermittere* (15c) 1: the act of intermitting; the state of being intermitted 2: an interval between the parts of an entertainment (as the acts of a play) — **inter-mission-less** *adj* — **inter-mit** \in-'mits\ *vb* -**mit-ted**; -**mit-ting** [L. *intermittere*, fr. *inter-* + *mittere* to send — more at **SMITE**] *v* (1542): to cause to cease for a time or at intervals: **DISCONTINUE** ~ *vi*: to be intermittent — **inter-mit-ter** \in-'mit-ter\ *vt* -**mit-ting** *adj* [L. *intermittent*, *intermittens*, pp. of *intermittere*] (1603): coming and going at intervals; not continuous (~ rain); also: **OCASIONAL** (~ trips abroad) — **inter-mit-tence** \-n(t)s\ *n* — **inter-mit-tent-ly** *adv* — **inter-mix** \intin-ər-'mɪks\ *vb* [back-formation fr. obs. *intermixt* (inter-mingled), fr. L. *intermixtus*, pp. of *intermiscere* to intermix, fr. *inter-* + *miscere* to mix — more at **MIX**] *v* (1542): to mix together ~ *vi*: to *miscere* to mix — more at **MIX**] — **inter-mix-ture** \-mɪks-čər\ *n* — become mixed together — **inter-mo-lec-u-lar** \intin-ər-'mə-'lek-yə-lər\ *adj* (1843): existing or acting between molecules — **inter-mo-lec-u-lar-ly** *adv* — **inter-mon-tan-ous** \intin-ər-'mən-tən\ or **inter-mont** \intin-ər-'mənt\ *adj* (1807): situated between mountains (an ~ basin) — **in-tern** or **inter-ne** \in-'tɔrn, -nə\ *adj* [MF. *interne*, fr. L. *internus*] archaic (1508): **INTERNAL** — **in-tern** \in-'tɔrn, -nə\ *vt* (1866): to confine or impound esp. during a war (~ enemy aliens) — **in-tern-ee** \(hīn-'tɔrn-'nē\ *n* — **in-tern-ment** \in-'tɔrn-mənt, -nə\ *n* — **in-tern-ship** \in-'tɔrn-'ʃɪp\ *n* [F. *interne*, fr. *interne*, *adj.*] (ca. 1879) 1: an advanced student or graduate usu. in a professional field (as medicine or teaching) gaining supervised practical experience (as in a hospital or classroom) — **in-tern-ship** \in-'tɔrn-'ʃɪp\ *n* — to act as an intern — **in-tern-al** \in-'tɔrn-'l\ *adj* [L. *internus*: akin to *inter* between] (15c) 1: existing or situated within the limits or surface of something: as a (1): situated near the inside of the body (2): of relating to, or occurring toward the confines of an organized structure (as a club, company, or within the confines of a country's ~ food production) 2: relating or belonging to affairs: a country's ~ reputation 3: **INTRINSIC**, **INHERENT** (~ belonging to forgers in a document) 4: present or arising within an evidence of forgery in a document 5: applied or intended for organization or one of its parts (~ stimulus) 6: being swallowed (an ~ remedy) applied through the stomach by which the food is digested — **in-tern-al-ity** \in-'tɔrn-'l-ə-ti\ *n* — **in-tern-al-ly** \in-'tɔrn-'l-ē\ *adv* — **internal-combustion engine** *n* (1884): a heat engine in which the combustion that generates the heat takes place inside the engine proper instead of in a furnace — **internalise** *Brit* var. of **INTERNALIZE** — **in-tern-al-ize** \in-'tɔrn-'l-ə-ɪz\ *v* -**ized**; -**izing** (1884): to give a subjective character to: *specif*: to incorporate (as values or patterns of culture) within the self as conscious or subconscious guiding principles through learning or socialization — **in-tern-al-iza-tion** \in-'tɔrn-'l-ə-'zā-shən\ *n* — **internal medicine** *n* (ca. 1904): a branch of medicine that deals with the diagnosis and treatment of nonsurgical diseases — **internal respiration** *n* (ca. 1890): an exchange of gases between the cells of the body and the blood by way of the fluid bathing the cells — compare **EXTERNAL RESPIRATION** — **internal rhyme** *n* (1903): rhyme between a word within a line and another either at the end of the same line or within another line — **internal secretion** *n* (1895): **HORMONE** — **inter-na-tional** \in-'tɔrn-'nə-shənəl, -nəl\ *adj* (1780) 1: of, relating to, or affecting two or more nations (~ trade) 2: of, relating to, or constituting a group or association having members in two or more nations (~ movement) 3: active, known, or reaching beyond national boundaries (the ~ set) 4: ~ reputation — **inter-na-tional-ity** \in-'tɔrn-'nə-shən-ə-l-ə-ti\ *n* — **inter-na-tional-ly** \in-'tɔrn-'nə-shən-ə-l-ē\ *adv* — **international** *n* (1871): one that is international: esp: an organization of international scope — **international date line** *n* (ca. 1909): **DATE LINE** — **inter-na-tional-ize** *Brit* var. of **INTERNALIZE** — **in-ter-na-tion-al-ism** \in-'tɔrn-'nə-shən-əl-iz-əm\ *n* (1851) 1: international character, principles, interests, or outlook 2: a: a policy**

[illegible]